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MOBICASCAIS' BIKE-SHARING OPERATIONS – A CASE STUDY

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Abstract

This paper is an analysis of MobiCascais' bike-sharing operations, which includes, for example, the description of the customer process, the study of capacity, and the strategic alignment fit. Information was collected by observation, on the websites of the companies and county, as well as news articles. The main challenges found regarded, managing customers, the digital platforms, the irregular distribution of the direction of trips, dock location, electrical bicycles, usage of helmets, and durability of the bicycles. Some recommendations include instrumental and normative means to manage customers, partnerships, and helmet-sharing systems, based on international examples.

Keywords

Bike-sharing; Service Management; Operations Strategy; MobiCascais

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1. Introduction: Why is it relevant to analyse the bike-sharing business?

For the first time, in 2007, the number of people living in urban areas was roughly equal to the number of people living in rural areas, at about 3.33 billion people in each. Since then, the urban population has been increasing at a faster pace than the rural population, with trends projecting that, by 2050, this number will reach 68% of the world's population (Ritchie et al., 2018). However, many urban areas are not adapting fast enough to the growing population due to legacy infrastructure and limited budgets, leaving cities to suffer from congestion, lost economic potential, lower quality of life, and negative health outcomes (Corwin et al., 2019).

In recent years, we have seen the emergence of solutions to this problem with mobility innovations such as car-sharing, bike-sharing, and e-scooters. Still, these are isolated point solutions that may not be enough and even aggravate the current inefficiencies with additional complexity and transaction costs. A possibly better solution would be a **mobility operating system** to integrate and coordinate the new services with the existing transportation systems in a transparent digital platform. Nevertheless, this is not a "one-size-fits-all" concept. While in countries like China, where new planned cities are being built, these systems can be implemented from the beginning, in other countries like Portugal, that are more constrained by existing infrastructure, it is likely more efficient to develop on what already exists (Corwin et al., 2019).

MobiCascais is a great example of a system that is growing in this direction. It appeared in July 2016 from the necessity to integrate different means of transportation and to contribute to the shift from the use of individual to public transportation. Its services include bus, train, car parking, car-sharing and bike-sharing in a single platform (MobiCascais, n.d. (a)).

While in Portugal, the idea of **bike-sharing** is relatively new, the first mention of this concept dates back to the 1960s. However, the spurt of this business only happened with the development of better methods of tracking bicycles in the 1990s. These technologies include

electronically-locking racks or bike locks, telecommunication systems, smartcards and fobs, mobile phone access, and on-board computers (DeMaio, 2009).

The present paper is a case study of the operations of MobiCascais' business segment of bike-sharing. The first part consists of a descriptive analysis organized by the company and its offering, the funding mechanism, the customers and the customer management system, the customer process, the capacity, the implications from servitization, and, finally, the strategy alignment, while exploring the different challenges that the company faces in these areas. The second part includes a case synopsis, the case objectives and courses where it may be used, and proposed subjects for discussion related to the mentioned challenges, with international examples. Information was collected by observation, on the websites of the companies and the Cascais' chamber, as well as news articles.

2. The Company and the Offering

MobiCascais is a pioneering initiative that is pushing Cascais towards the goal of becoming a smart city, developing the pillar of intelligent mobility (Smart Cities Network, 2019 (b)). It required an investment in electric solutions and micro-mobility solutions, such as electric bicycles and scooters, the bike-sharing system, a partnership with Hertz for a car-sharing service for electric vehicles, electric chargers, and electric buses (Smart Cities Network, 2019 (a)). The company also counts on partnerships with *Comboios de Portugal* and *Via Verde*, to integrate a wider variety of mobility services (MobiCascais, n.d. (a)).

MobiCascais' **offering** consists of a solution for mobility in Cascais, integrating several public transportation means, car parking, and bike-sharing. Currently, its offer includes 12 different subscriptions for these solutions that can be added to be used with the same card (**Exhibit 1**) (MobiCascais, n.d. (a)). As for the bike-sharing services, it is available throughout

the whole year, but only functions from 7 a.m. to 8 p.m (MobiCascais, n.d. (b)), which limits the amount of rides per day and the revenue generated.

The company excels at integrating the different means of transportation, at offering low cost, easy and fast mobility alternatives for its customers, and at contributing towards a more sustainable and smart urban mobility system. In order to integrate different means of transportation, MobiCascais does not benefit from the advantages of focus, like companies that operate only bike-sharing, for example. However, with the offering centred on affordable service, there are no premium solutions for high-end customers. Nonetheless, to encourage the transition to public transportation, the locations with free parking space for cars is limited.

Bike-sharing, also called "Public-Use Bicycles", "Bicycle Transit", or "Smart Bikes", consists on short-term rental of urban bicycles that can be picked up and returned at different locations and allow customers to benefit from the utility of bicycles without the costs and responsibilities of ownership (Shaheen et al., 2010). Usually, the motivation to establish a bike-sharing program lies in promoting cycling and its health benefits, increasing the variety and flexibility of mobility choices, reducing congestion and emissions, raising environmental awareness and supporting multimodal transport connections by providing a solution for the first/last mile (Shaheen, 2010; Fishman et al*.,* 2012). While public transportation has usually fixed routes, people are only willing to walk up to 10 minutes. That is where cycling emerges as a solution since willingness to bike goes up to 5km (Midgley, 2011).

MobiCascais operation is limited to the county of Cascais, which is a Portuguese municipality in the Lisbon district with more than 200 thousand inhabitants, in 2018. From these, about 25 thousand were foreign (Cascais Data, n.d. (c)), which shows the need for services to be prepared to deal with people who might not speak Portuguese and have different cultures. In 2017, more than 90% of companies from Cascais belonged to the tertiary sector, with a growing presence of tourism-related activity (Cascais Data, n.d. (a)). This might bring

temporary customers who are not interested in long term subscriptions. The county counts with good infrastructure, including a railway that crosses almost all of the coast of the county, connecting Cascais and Lisbon, and 23 km of bicycle path (in 2017) (Cascais Data, n.d. (b)), which contributes for a pleasurable use of bicycles as a mean of transportation or as a recreational activity. However, in this municipality there is still a very high use of personal cars, with high levels of traffic at certain hours of the day, high emissions and high frequency of accidents (Augusto, 2017).

3. The Funding Mechanism

The revenue source of the bike-sharing service is based on subscriptions (**Exhibit 1**). This allows for continuous revenue for the company and facilitates the process for the usual customers. Currently, payment for used time is not available on neither digital platforms.

One of the main objectives of MobiCascais, as a township of Cascais' initiative, is to offer affordable services to its customers. Therefore, they must fund the excellence of their service through the reduction of costs.

The typical **operational costs** of a bike-sharing business include maintenance of the bicycles, distribution, staff, insurance, office space, storage facilities, website hosting and its maintenance, and electricity. Regarding **capital costs**, that continue to occur while the business is growing, there are the procurement of the bicycles, the installation of docks, licenses or purchase of the back-end systems used to operate the equipment, member access cards, and purchase or rental of maintenance and distribution vehicles (DeMaio, 2009).

4. The Customers and Customer Management System

People might have different reasons to use the bike-sharing service, such as getting to a place or as a recreational activity. There can also be frequent customers, who are residents and

people who work or study in the city, and one time users, such as tourists (Munkácsy et al., 2017). The residents of Cascais are highly qualified, have a purchasing power above the national average and an unemployment rate below the national average, and demonstrate concerns with the environment (Augusto, 2017). The tourists that visit Cascais are mostly English, Spanish, and French, staying for 5 days, on average, and motivated by leisure (Cascais Data, n.d. (d)).

A study by Munkácsy et al. (2017) found that both subscribers and occasional users of a bike-sharing program give higher importance to factors related to infrastructure, such as bicycle routes, parking places and the efficient integration with public transport. Here, MobiCascais is in a good position, given the long bicycle routes in Cascais (23 km as mentioned previously), the large quantity and dispersion of docks and the integrated system of MobiCascais for different means of transportation.

In most services, as in this one, customers are **operators** and affect the service provided to them and to others. Therefore, there is a special need for the management of customers to ensure good quality and fluidity of the process, as well as a good utilization of the company's physical assets. Customer Management can be achieved through job design and variability management (through instrumental or normative means), for example.

As for **job design**, MobiCascais has done a good job at simplifying the process and using new technologies to allow for serf-service docks. The whole customer process, which is detailed in the next section (**5.**), is explained to customers through the website, which includes a FAQ page and videos, as well as in the totems present in the docks (**Exhibit 2**). Still, they can have access to help through Customer Support lines: in-person in specific locations, by phone, by email or even through their Facebook page (MobiCascais, n.d. (a)).

Regarding **variability management**, MobiCascais counts mostly on instrumental means, such as fines, to reduce variability in **effort**. For that reason, when creating an account with

MobiCascais, the customer must authorize the company to charge from their bank account the amount needed to replace or repair any damaged or not returned material. Additionally, if customers do not return a bicycle at any dock after a maximum of 2 hours, plus a 10-minute tolerance, a monetary penalty is applied (MobiCascais, n.d. (b)). There are no explicit efforts to put normative means into action. Also important for managing customers is assuring that they have the necessary skills to do the job. The hardest part of the process is riding the bicycle, where customers have variable **capability**. This is a factor that reduces the pool of potential users of the service.

5. The Customer Process

5.1. Description of the process

The process for the client has two possible beginnings. On the one hand, it can start with the client accessing the website or the app, creating an account, and subscribing to the desired services at home. Then, he or she can locate a dock using a map available both on the website and in the mobile app (**Exhibit 3**) (MobiCascais, n.d. (b)). On the other hand, the client can find a dock and spontaneously decide to use the service. In this case, the totem (**Exhibit 2**) at the dock explains the whole process to the customer, who will then create the account on the spot.

After having an account with the desired services, the customer can unlock a bicycle using the mobile app. Additionally, the customer can get a physical card either by going to a specific location or by asking the company to send it by mail. The card uses **Near Field Communication** to unlock the bicycle simply by approaching the card to the dock and can be used for all the other MobiCascais' services, such as bus.

After unlocking a bicycle, the customer can use it for 2 hours. However, after this time, they can go to the closest dock, park the bicycle and unlock it again to continue using it (MobiCascais, n.d. (b)).

During the usage of the bicycle, the client may have an accident. It is expressed in the Terms and Conditions that the users of the bicycles are the only responsible for accidents that they may cause. Still, the company offers liability insurance to cover damage caused on others by the use of its bicycles. Also, the company requests the customers to report the accident to the competent authorities and deliver a copy of the document to them (MobiCascais, n.d. (b)).

The last step of the process for the client is to return the bicycle to a dock, ensuring that it is locked properly.

5.2. Process-related challenges found

Many authors used different dimensions to evaluate the quality of an online service (Li et al., 2009), but the most commonly used and relevant for MobiCascais' digital platforms are efficiency, availability, privacy/security, and responsiveness.

Firstly, the **efficiency** is the ease and speed of accessing and using the platforms and **availability** refers to the correct technical functioning of the website or mobile app. From direct observation, both the website and the mobile app looked intuitive and light, but it was impossible to create an account since after all the information was inserted, an error message appeared. Moreover, the app has bad reviews, with an average of 3 and 2 stars out of 5 in the App Store and Play Store, respectively. The users' comments mention the bad functioning of the mobile app and the system itself **(Exhibit 4**).

Regarding **privacy** and **security**, which are especially important given the introduction of personal data and the performance of payments online, the company informs customers that the data is collected with the purpose of billing, communicating with them, processing information requests and possible complaints, and statistical analysis, assuring a commitment to privacy and security of this data (MobiCascais, n.d. (b)). This respects the EU General Data Protection Regulation: Regulation 2016/679 of the European Parliament and of the Council.

Lastly, **responsiveness**, that is what happens when something goes wrong, MobiCascais counts on a FAQ page with some useful tips, but also contact information that customers can use to ask for help, including phone, email, Facebook, and physical locations where customers can talk face to face, as mentioned previously.

All in all, the registration is a long and mandatory process which might "stifle the spontaneity typically thought to attract people to public bike-share" (Fishman et al*.,* 2012).

Another challenge found regards the locking mechanism not working, as voiced by users in the app reviews (**Exhibit 4**). The user added that MobiCascais sent a staff member to help, but he/she considered it to take too long.

6. The Capacity

MobiCascais' bike-sharing has a limited capacity, which includes about 1.200 bicycles as well as available parking spots for customers to return them in more than 80 docks (Marques, 2019). There are 3 main challenges regarding capacity: how to manage the redistribution of bicycles by the docks, where to locate docks and what type of bicycles to use.

For customers to trust bike-sharing, the service must keep a high service level, i.e., users must feel that there will always be a bicycle and an available parking spot when and where they need, without spending a lot of energy looking for it (Bikeplus, 2016). As riding a bicycle is a partial substitute for other means of transportation, there is an inherent imbalance for the flow of bicycles, that can be caused, for example, by weather or traffic conditions, topography, or availability of the bus service at certain times (Raviv et al., 2013). Due to this irregular distribution of the direction of trips, sometimes there are more customers taking bicycles from a dock than returning them, creating a situation of **lack of capacity** in a certain dock. If the opposite situation occurs, i.e, more customers returning bicycles in a dock than starting the trip there, that dock will run out of available parking spots – **excess capacity** of bicycles. Indeed,

the main complaint customers of bike-sharing services have is "the unavailability of bicycles at their point of origin and unavailability of lockers at their destinations" (Raviv et al., 2013). Larger systems solve this issue with a truck/van based method, which consists of using vehicles (usually a van or truck) to move bicycles from dock to dock according to the needs of the system (Toole Design Group and the Pedestrian and Bicycle Information Center, 2012). However, this rebalancing method will generate additional costs as well as nullify the benefits of commuting by bicycle, by introducing traffic and producing CO_2.

A common challenge with several transportation solutions is the **last mile problem**: if there is not a dock within a 10-minutes' walk of where the customer wants to end their trip, they are likely not to use the bike-share (Midgley, 2011). When choosing the location for docks, companies must consider several factors such as: **potential demand** (looking at the density of land being used, the popular origin-destination trips that populations use the most, and the interceptions of other means of transportation), **space available** (space for the docks, for the totem and a reasonable amount of circulation space for users to handle the bikes), **convenience** (people are not willing to walk more than a few minutes to pick up a bicycle and experience has shown that people are less likely to walk away from their destination to pick up a bicycle), **safety and visibility** (visibility is relevant both for marketing and to minimize vandalism, offering a safe environment for users; proximity to safe cycling infrastructure is also positive) (Bikeplus, 2016).

Still, there are some missed opportunities for MobiCascais. For example, there is a dock near the Nova SBE campus but there is not a dock close to the train station of Oeiras, that most students use to go back to Lisbon. Given that the other train stations have a relatively close dock, this might be explained by the location of the train station outside the county of Cascais. The geographical limitation of operations to the county of Cascais represents a challenge specially in the frontier locations and for tourists who want to visit a broader area.

Finally, there are decisions to be made regarding **capacity type**. Although recently there was investment in electrical bicycles, the main operations of MobiCascais are based on non-electrical ones. Changing to electrical bicycles implies an additional investment in the upgrade of the docks to include charging of batteries and increase operational costs with energy. But, on the other hand, it could increase the inclusiveness and expand the pool of customers by reducing the effort needed to use the bicycle, for example for older people.

When deciding what models of bicycles to purchase, bike-sharing companies must have into account that these need to be easy to use, adaptable to users of different sizes and cycling capabilities, mechanically reliable, resistant to vandalism or theft, and distinctive in appearance. Also, these bicycles require a tracking mechanism (Midgley, 2011).

One item not included in MobiCascais' offering, as well as most bike-sharing services, is the helmet. According to the Portuguese "*Código da Estrada*", the use of a helmet while riding an electric bicycle is mandatory. For non-electrical bicycles, it is not mandatory but is still recommended (Rádio Renascença, 2018). Fishman et al. (2012) found in a study for an Australian bike-sharing company that 61% of respondents did not use the bike-sharing service because of issues related to helmets. Moreover, about half of the bicycle injuries that result in hospitalization are from off-road incidents (Fishman et al., 2012), which means that helmets are **not superfluous**. Since people might not own a helmet or consider inconvenient to carry a helmet throughout the day, this is one of the main barriers to the use of bike-sharing programs.

7. Bike-sharing as a form of Servitization and Product-Service Systems

Servitization is the process of transition of business models from traditional product-based models to product-service system (PSS) business models (Vandermerwe et al., 1988). According to Yang et al. (2019), a generally accepted approach to classify PSS is the three archetypes defined by the ratio of service and ownership of the product: product-, use-, and

result-oriented. Product-oriented PSS consists of selling a product and additional services (maintenance, for example). In use-oriented PSS, the company keeps the product as its asset and sells the utility, availability or function of products (renting, for example). Result-oriented PSS is about selling the result of a product, being the company not only the owner but also the user of the physical good (such as the Philips' pay-per-lux model, where business customers pay a subscription and the company manages the whole lighting service (Goldapple, 2016)).

In this framework, MobiCascais' bike-sharing program is classified as a **use-oriented product-service system**, since the company is the owner of the bicycles and the docks, but rents the assets to be used by customers. Generally, people do not want to own a bicycle, but rather benefit from its utility, either to get from point A to point B or as a recreational activity.

The value created varies for the different PSS. In product-oriented PSS, the main source of revenue for the company is the sale of the products it produces and the respective accessories and complements. Therefore, it has an incentive to maximize the quantity of products sold and no incentive to extend product life. In use- and result-oriented PSS, the firms sell the use of the product and will maximize the value reaped by expanding the life of the products, either by using longer-lasting materials or by promoting good use of the assets (Yang et al., 2019).

In the case of use-oriented PSS, like MobiCascais, with the customer as the user, there is a need to control their behaviour to ensure the good use of the bicycles. Accordingly, servitization has a significant effect on MobiCascais' decision-making process on assets' purchase, design of the process and management of customers' behaviour, and support activities, such as maintenance (Corrêa, 2018).

8. Strategy Alignment

"Operations strategy should develop resources and configure processes such that the resulting competencies are aligned with the competitive position that a firm seeks over time." (Mieghem,

2008, 18). As it was detailed throughout this paper, MobiCascais' main **resource developments** are: high geographical density of docks, trying to locate them in a way to complement other means of transportation and to be a good solution to the last mile problem, growing this number when there is a new opportunity to achieve more clients with certain routes; managing the fleet of bicycles, gradually investing in electric bicycles to increase the pool of potential users; and several channels to support customers.

Its **fundamental processes** consist of: integration of client accounts for different services; balancing the availability of bicycles and parking spots at each location, to ensure a certain service level; and managing customers and their behavior. Also essential for the process are the technologies used, from the tracking devices, locking mechanisms, the NFC (Near Field Communication) cards and the support of the C3 – *Centro Controlo Cascais*, where MobiCascais' systems are managed in real time (Augusto, 2017).

These resources and process result in **3 central competences**: the know-how to integrate the bike-sharing service with other means of transportation; the ability to provide low cost mobility solutions; and the application of new technologies to facilitate the process and the management of the service. These are aligned with the **competitive position** of MobiCascais, which is stated to be providing an **affordable** and **simplified** mobility solution to both residents and visitants of the city, by managing a system to share bicycles, **integrated** with other means of transportation, contributing for the sustainable development of Cascais towards a **smart city**.

9. Conclusion: Main challenges

All in all, MobiCascais is a great step towards the transformation of Cascais in a smart city by offering a platform for the integration of the existent mobility infrastructure (train rails, for example) with new technologies and solutions (such as electric bicycles and bike-sharing). Nonetheless, it still has some operational challenges that it must surpass to achieve maximum

value creation for the company and the customers, from the bike-sharing service. These include the tourists, being temporary users, may be pushed away by the need to create an account; the need to keep costs low in order to offer an affordable service, maintaining the quality; managing customer behaviour, given the self-service and renting nature of the system, as well as variability in capability of customers; the functioning of the website and mobile app, that has bad reviews from users; the lack of bicycles or of available parking spaces in a dock; where to locate the docks to solve the last mile problem and the geographical limitations; the choice between electrical and non-electrical bicycles; the issues with the absence of helmets; and the need to extend the useful life of the bicycles.

The second half of this paper will include a discussion of these challenges, as well as an exposition of some international examples of actions that aim to solve them. But as Corwin et al. (2019) stated, with mobility operating systems there is no "one-size-fits-all". MobiCascais can look outwards for inspiration but needs to adapt to the present reality of its market.

List of references (for part A)

Augusto, Paulo. 2017. "O Sistema Integrado de Mobilidade MobiCascais." Master's Dissertation, Faculdade de Ciências e Tecnologia da Universidade de Coimbra. http://hdl.handle.net/10316/82845.

Bikeplus. 2016. "The Bikeplus Guide to Successful Bike Share Scheme Development." Accessed December 2. https://como.org.uk/wp-content/uploads/2018/06/Bike-Share-Procurement-Guidance-HI-RES.compressed.pdf.

Cascais Data. N.d. (a). "Economia." Accessed December 2. https://data.cascais.pt/pt-pt/economia.

Cascais Data. N.d. (b). "Mobilidade." Accessed December 2. https://data.cascais.pt/pt-pt/mobilidade.

Cascais Data. N.d. (c) "Retrato de Cascais." Accessed December 2. https://data.cascais.pt/.

Cascais Data. N.d. (d) "O Turista que Visita Cascais." Accessed December 15. https://data.cascais.pt/pt-pt/Perfil%20do%20Turista.

Corrêa, Henrique. 2018. "Servitization meets sustainability." *Future Studies Research Journal: Trends & Strategies* 10 (2): 358-364.

Corwin, Scott; Dinamani, Anant; and Pankratz, Derek. 2019. "Toward a mobility operating system: Establishing a lingua franca for urban transportation." *Deloitte Insights*.

DeMaio, Paul. 2009. "Bike-sharing: History, Impacts, Models of Provision, and Future." *Journal of Public Transportation* 12 (4).

Fishman, Elliot; Washington, Simon; and Haworth, Narelle. 2012. "Barriers and facilitators to public bicycle scheme use: A qualitative approach." *Transportation Research Part F: Traffic Psychology and Behaviour* 15 (6): 686–698.

Goldapple, Lisa. 2016. "Let there be (intelligent) light." Accessed December 15. https://atlasofthefuture.org/project/pay-per-lux/.

Li, Hongxiu, and Suomi, Reima. 2009. "A Proposed Scale for Measuring E-service Quality." *International Journal of u- and e-Service, Science and Technology* 2 (1).

Marques, Paulo. 2019. "MobiCascais - o sistema integrado de mobilidade sustentável do concelho de Cascais." *Centro Rodoviário Português*. http://www.crp.pt/docs/A54S218-9CRP_Artigo_62.pdf.

Midgley, Peter. 2011. "Bicycle-sharing schemes: Enhancing sustainable mobility in urban areas." *United Nations, Department of Economic and Social Affairs*.

Mieghem, Jan. 2008. *Operations Strategy: Principles and Practice*. Belmont: Dynamic Ideas.

MobiCascais. N.d. (a). "Cascais. Mais fácil, rápida e barata." Accessed December 2. https://www.mobicascais.pt/about.

MobiCascais. N.d. (b). "Condições Gerais de Utilização dos serviços de Bike Sharing e de Bike Parking." Accessed December 2. https://www.mobicascais.pt/assets/cascais/docs/terms-conditions.pdf.

Munkácsy, András, and Monzón, Andrés. 2017. "Potential User Profiles of Innovative Bike-Sharing Systems: The Case of BiciMAD." *Asian Transport Studies* 4(3): 621–638.

Rádio Renascença. 2018. “O capacete é obrigatório? As bicicletas podem andar no passeio? PSP explica as regras.” Accessed December 2. https://rr.sapo.pt/2018/09/21/pais/o-capacete-e-obrigatorio-as-bicicletas-podem-andar-no-passeio-psp-explica-as-regras/noticia/125155/.

Raviv, Tal, and Kolka, Ofer. 2013. “Optimal inventory management of a bike-sharing station.” *IIE Transactions* 45: 1077–1093.

Ritchie, Hannah, and Roser, Max. 2018. “Urbanization.” Accessed December 2. https://ourworldindata.org/urbanization.

Shaheen, Susan; Guzman, Stacey, and Zhang, Hua. 2010. “Bikesharing in Europe, the Americas, and Asia: Past, Present, and Future.” *Washington D.C.: Transportation Research Board Annual Meeting*.

Smart Cities Network. 2019 (a). “Cascais, a vila onde todos os caminhos vão dar à eletrificação.” *Smart Cities Network*.

Smart Cities Network. 2019 (b). “O ecossistema MobiCascais no centro da economia circular.” *Smart Cities Network*.

Toole Design Group and the Pedestrian and Bicycle Information Center. 2012. “Bike Sharing in the United States: State of the Practice and Guide to Implementation.” Accessed December 2. https://www.bikesharing.ch/fileadmin/redaktion/bikesharing/Dokumente/Documents_et_autres/Bikesharing_in_the_United_States.pdf.

Vandermerwe, Sandra, and Rada, Juan. 1988. “Servitization of business: Adding value by adding services.” *European Management Journal* 6 (4): 314–324.

Yang, Miying, and Evans, Steve. 2019. “Product-service system business model archetypes and sustainability.” *Journal of Cleaner Production* 220: 1156–1166.

Exhibits (for part A)

Exhibit 1 – MobiCascais' subscriptions.

Name	Price and duration	Mean of transportation included
MobiCascais	€20 for 30 days	Bike-Sharing + Bus in Cascais
Navegante Cascais	€30 for 1 month	Bus in Cascais
Navegante Metropolitano	€40 for 1 month	Bus both in Cascais and Lisbon
Mobi Buscas Diário	€1 for 1 day	Bus in Cascais
Compl. Bike-Sharing	€5 for 1 month	Bike-Sharing
Compl. Car-Sharing	€10 for 1 month	Car-Sharing by Hertz
Bike-Sharing 1 dia	€3.9 for 1 day	Bike-Sharing
Bike-Sharing 7 dias	€6.9 for 7 days	Bike-Sharing
Bike-Sharing 30 dias	€10 for 30 days	Bike-Sharing
Bike-Sharing 365 dias	€44.9 for 365 days	Bike-Sharing
Bike-Parking 30 dias	€3 for 30 days	Bike-Parking
Bike-Parking 365 dias	€29.9 for 30 days	Bike-Parking

Exhibit 2 – Totem at the docks with information.

Exhibit 3 – Map of bike-sharing docks available in the website.

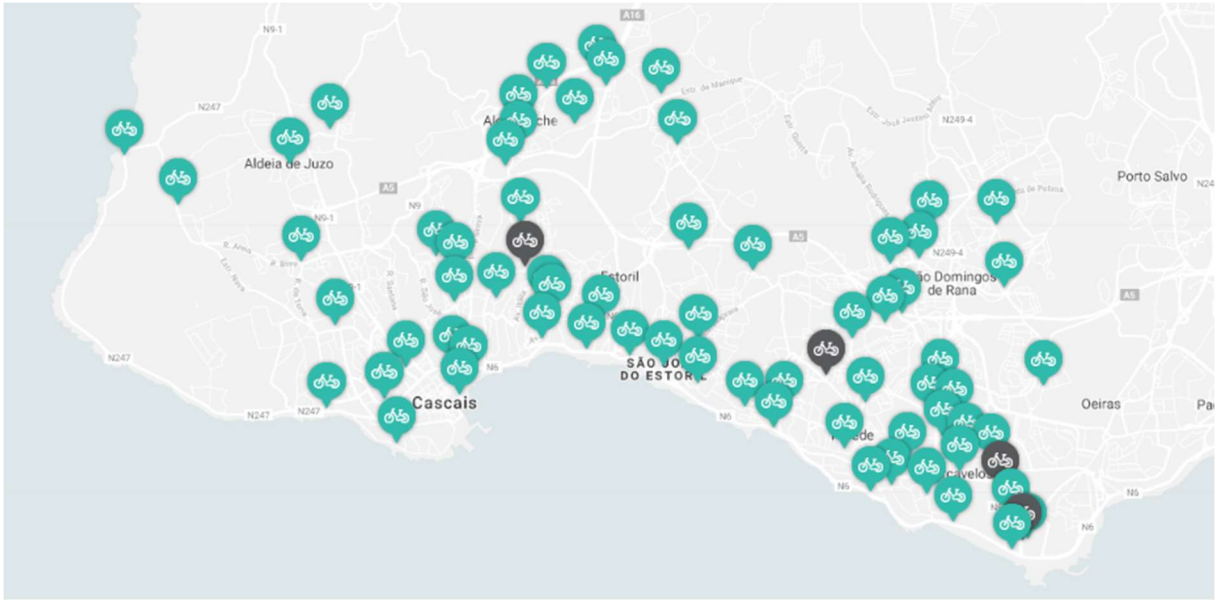
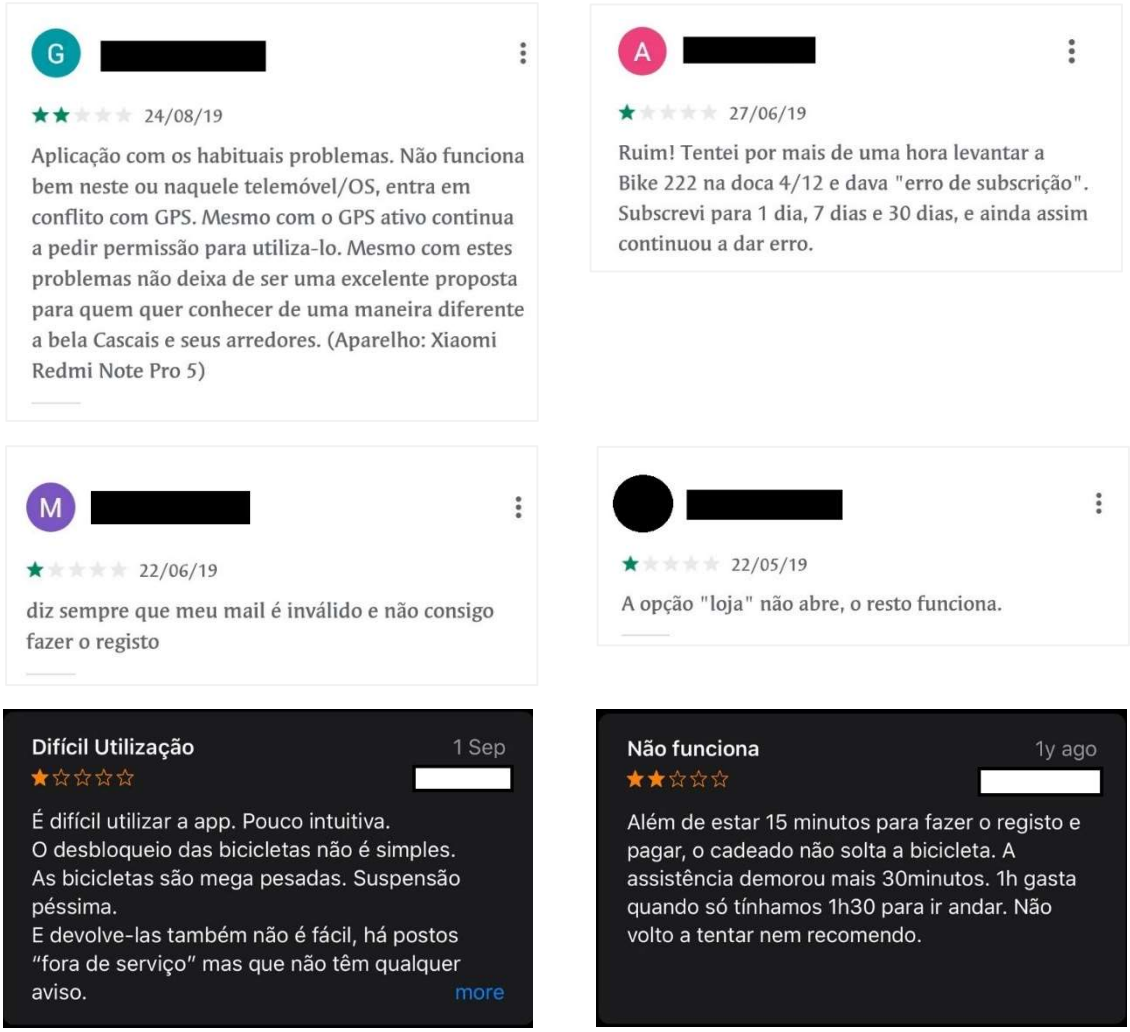


Exhibit 4 – Reviews of the MobiCascais' mobile app in the AppStore and PlayStore.



10. Case Synopsis

The number of people living in cities is increasing faster than these cities can adapt their mobility solutions, mainly due to legacy infrastructures and limited budgets. Some cities are implementing **mobility operating systems** to integrate and coordinate different means of transportation in a single platform (Corwin et al., 2019), such as MobiCascais. One of the services that MobiCascais provides is bike-sharing, which is a short-term rental of bicycles that can be picked up and returned at different stations, allowing customers to benefit from the utility of bicycles without the costs and responsibilities of ownership (Shaheen et al., 2010).

MobiCascais is a municipal initiative of the Cascais City Hall, managed by the municipal company *Cascais Próxima*. Its **offering** includes bus, train, car parking, bicycles and scooters. One of the main objectives of MobiCascais, is to offer affordable services to its customers. Therefore, the service must be funded through the **reduction of costs**.

People use the bicycles to get to a place or as a recreational activity, and can be frequent customers or one time users. In bike-sharing, **customers are operators** and their behaviour needs to be managed. The process is explained to potential users through the website and the totems at the docks. Still, they can ask for help through Customer Support channels. People have variable levels of skill for riding a bicycle, which can be a barrier to the use of the service. Variability management is mostly based on fines to any damaged or not returned material.

The **customer's process** includes the creation of an account on the website or mobile app, the option to get a physical card, the location of a dock, the unlocking of the bicycle, using it and returning it. The main challenge found was the functioning of the digital platforms.

The **capacity** of the bike-sharing system includes the bicycles but also the available parking spots. Due to the imbalances in the direction of trips, it is possible to have a dock with no bicycles and another without available parking spots. While the most common solution is to move bicycles with a van, this has additional costs and contributes to traffic and CO_2 emissions.

For the bicycles to be an efficient solution to the last mile problem, the docks must be **located** in ideal areas, having into account potential demand, space available, convenience, safety and visibility. Regarding capacity **type**, the bicycles need to be easy to use, adaptable to users of different sizes and cycling capabilities, mechanically reliable, resistant to vandalism or theft, distinctive in appearance and include a tracking mechanism (Midgley, 2011). There is also a choice between electrical or non-electrical bicycles to be used. A significant barrier to the use of bike-sharing programs is that the offer does not include the safety helmets.

MobiCascais' bike-sharing can be considered a **use-oriented product-service system** since the company is the owner of the bicycles and the docks, but rents the assets to be used by customers (Yang et al., 2019). Also, seeing MobiCascais as a form of servitization can impact the decision-making process on assets' purchase, design of the process and management of customers' behaviour, and support activities, such as maintenance (Corrêa, 2018).

The last chapter summarizes MobiCascais' main resources and processes, which result in its central competencies: the know-how to integrate the bike-sharing service with other means of transportation; the ability to provide low cost mobility solutions; and the application of new technologies to facilitate the process and the management of the service. Accordingly, it is concluded that these are aligned with its competitive position.

11. Case objectives and courses where it may be used

The main objectives of this case study are to understand the operational complexity of a bike-sharing service and the main challenges that companies face when trying to establish and develop this service, as well as encourage the discussion of solutions and improvements with the goal of providing the better possible quality and safety to customers at a sustainable cost.

Accordingly, this case study would be suitable to be discussed in a **Service Management** class since the operations of this service are thoroughly described. It can be presented as a

practical application of the Service Model by Frei (2008) and the customer as an operator, the process blueprint, service location and capacity planning as well as web platforms.

Furthermore, this case study can be used in an **Operations Strategy** class, given the strategic decisions on capacity size, timing and types, choices on outsourcing, the impact of the introduction of operations 4.0 elements in the creation of new services, and finally the alignment between the firm's developed competencies and its competitive positioning.

12. Suggested questions with discussion and relevant literature

The previous analysis of MobiCascais' bike-sharing operations found several challenges that the company needs to tackle to optimize its impact in the community and in the goal of transforming Cascais in a smart city. This section will discuss those challenges and present some international examples of what other programs are doing to reduce the negative effects.

12.1. Temporary users may be pushed away by the need to create an account

Fishman et al. (2012) found that a crucial element to using bike-sharing was spontaneity, but which is "the ability to use the bike on impulse, without the need to register details manually, either over the phone or online". However, as described in the case study, customers are required to create an account in the MobiCascais' platform to use the service of bike-sharing. For the MobiCascais' case, it makes sense for users to have a single account to benefit from the integration from many mobility solutions. However, creating a **parallel payment system** for one-time users who are visiting the city could increase their willingness to buy the service.

A simpler process could be designed including only the three main customer actions needed: reading and agreeing with terms and conditions; preceding with the payment for one day; and leaving at least one contact information, such as the number of the smartphone used to make the payment. In such a way, MobiCascais' would still be able to charge additional value for fines if needed and contact the customer in case of other problems.

12.2. Managing customers

In terms of **job design**, MobiCascais is doing a good job at simplifying and explaining the process to customers (**Exhibit 5**). Regarding **variability management**, the biggest challenge is in assuring customers have the needed skill to ride a bicycle. For example, the Indego system provides free classes for users to learn not only how to ride a bicycle but also about traffic and safety rules. The company complements this offer with group rides to help integrate and give confidence to new riders, tackling variability in capability (Indego, n.d.). Other actions to manage customers' behaviour are explained in the following chapters (**12.4** and **12.8**).

12.3. Functioning of the website and app

Both digital platforms have the potential to be improved, as seen by customers' feedback. If the management of these platforms is made by MobiCascais, a solid solution would be to **outsource** that responsibility. On the one hand, this would allow MobiCascais to focus its resources on the core business and lower costs related to the platforms. On the other hand, leveraging on a company with know-how in managing digital platforms would result in higher quality. However, if there is already a partner responsible for the management of the platforms, MobiCascais should either find a more efficient one or design an **incentive scheme** to encourage the partner to improve quality. MobiCascais could create KPIs to evaluate the partners' results and reflect it in the payment model chosen in order to motivate good maintenance of the system. The KPIs must include the most critical elements of the platforms, such as the proportion of errors in creating an account over the accounts created, the number of complaints from customers, or even the rating of the app.

12.4. Lack of bikes or available parking spots in a dock

One of the main challenges of bike-sharing with fixed-location docks is managing capacity to avoid lack of bicycles or available parking spots in certain docks at certain times.

CitiBike in New York has the Bike Angels program, where users receive points when taking a bicycle from a full dock to an empty one, which can then be traded by discounts. The

company also keeps a leader board and offers gift cards to the users with more points (CitiBike, n.d.). This board can be used as a **positive normative tool** to manage customers' behaviour, and use gamification as a way to increase consumption. The downsides of this solution are the dependency on a third party to manage capacity and the cost of giving the rewards.

Vélib' Métropole in Paris has an **overflow management system** that allows users to park a bicycle in between two other if the dock is full. This minimizes the instances where customers cannot return the bicycle because there are no available spaces and increase the number of bicycles in more popular docks during rush hours (Velib' Metropole, n.d.). This is a good solution for the lack of available parking spaces but not much if there is a lack of bicycles. However, this solution could be complemented with **extra bike storage**. If a certain location frequently has lack of supply of bicycles, for example near a train station, it might become more cost-effective to rent a safe storage space nearby instead of sending vans (Bikeplus, 2016).

Similar to the truck method mentioned in the case study is the solution implemented by San Antonio B-cycles (Texas, USA), which consists in using a bicycle that carries a trailer with the service bicycles to other docks (**Exhibit 6**). This solves the inconveniences of additional costs with operating a truck and producing additional CO_2 (Toole Design Group and the Pedestrian and Bicycle Information Center, 2012).

12.5. Where to locate docks

As MobiCascais' bike-sharing requires bicycles to be parked in fixed docks, there is a certain level of rigidity to its use. Therefore, it is crucial to locate said docks in the perfect area.

The users are the ones who know the best were docks are needed. Many bike-sharing programs such Divvy, in Chicago, include a "**suggest a station**" option for customers to suggest locations for new docks to be implemented (Divvy, n.d.). This is an easy way to get customers' input to decide on capacity location. Another initiative can be partnerships with companies or organizations with a high flux of people. The biggest challenges with this type of solution are

to find the right partners and to build a strong relationship with them. The Interfaith Medical Centre, in New York, partnered with CitiBike to totally or partially **subsidize employees' memberships** of the bike-sharing service (Hernandez, n.d.). The benefits for the partners include more reliable transportation for employees, reduced employee parking needs, lower healthcare costs, healthier and more productive employees (National Association of City Transportation Officials, 2019), as well as benefits for the bike-sharing provider, which gets access to more customers. One more example is Nice Ride, which made a partnership with ARTCRANK to leverage on **recreational users** and located docks near work of local artists through the city of Minneapolis and developed a marketing campaign to encourage people to take a bike ride and enjoy "an outdoor art show" (Nice Ride Minnesota, n.d.).

For the case of Cascais, it would be also important to partner with the **neighbouring town halls** to tackle the geographical limitations, installing docks in locations that are relevant for tourists or frequently used by the residents of the frontier areas.

12.6. The choice between electrical and non-electrical bicycles

Many systems use electric bicycles because of the benefits for customers, increasing the value of this mobility solution over other alternatives. Users can ride the bicycle effortlessly, getting to their destination quicker and avoiding the inconvenience of getting sweaty (Krug, n.d.). This brings potential customers, by minimizing the variability in capability: people with low fitness levels or health problems can get help to ride the bicycle.

However, electric bicycles require **higher investment** and **operational costs**: the bicycles are more expensive (MobiCascais, n.d. (b)), and, since the batteries need to be charged at the docks throughout the day, it requires the adaptation of the docks as well as the increased expenses in energy consumption. Some companies, such as ZYP (USA), generate their electric energy with **solar panels** at the docks (Zyp, n.d. (b)). This solution would have good prospects in Cascais, given the high solar power potential throughout the whole year (Noctula, n.d.).

12.7. The issues with the absence of helmets

The helmets are a massive barrier to bike-sharing programs. Fishman et al. (2012) present that non-users of the CityCycle service were reluctant to share a helmet for hygiene reasons, such as perspiration. However, users stated that, usually, the rides were not long or intense enough to perspire. In 2011, the Brisbane City Council allocated helmets to about a third of the fleet of CityCycle, which resulted in an increase in short-term usage. It was also observable that the bicycles with helmets were the first to be taken from the docks (Fishman et al., 2012).

MobiBikes, in Vancouver, developed a solution for the hygiene concerns. Additionally to frequently deep cleaning, it offers **disposile liners** at the docks (MobiBikes, n.d.).

Alternatively, some companies sell **folding helmets** to decrease the inconvenience of carrying it the whole day, such as Morpher (**Exhibit 7**) (Morpher, n.d.). MobiCascais could develop a partnership with a producer to advertise this solution. Still, good helmets are expensive and sharing is probably a cheaper solution than expecting customers to buy them.

12.8. The need to extend the useful life of the bicycles

MobiCascais rents the use of the bicycles but remains the owner of these assets. Hence, extending the useful life of bicycles is crucial to maximize the profit generated. The bicycles suffer an intensive use and are stored outside, where they are subject to atmospheric conditions on a daily basis, which wears out its components. Therefore, there is a need for a choice of durable components, attentive maintenance, and stimulation of conscious use by customers.

The main materials used for frames are aluminium, carbon fibre, titanium, and steel. The choice involves **tradeoffs** between comfort, weight, price, durability, and easiness to repair. Comfort and weight will influence users' experience and their willingness to continue using the service. Given the short nature of the rides, comfort may not be a priority. However, the weight can make it harder to ride the bicycle and reduce the number of people than have the ability to use it. This excludes **steel** frames from the viable options. To offer affordable prices,

MobiCascais must not spend too much in the bicycles, excluding **titanium** that is the most expensive, if there is not an opportunity for a partnership or a price reduction from quantity, for example. Still, to avoid spending in the future, the durability must also be considered. The **aluminium** frames (the most commonly used) have a lower expected life than carbon fibre and are not easily repaired. Still, for **carbon fibre** to have a longer duration, it requires good use from customers. With a higher initial investment and better control of customers, carbon fibre can make a longer-lasting fleet (Sumner, 2018). Additionally, using puncture-resistant tires is vital to decrease the need for repairing or even substituting. For example, in Barcelona, users report that there are typically 2 or 3 bicycles with flat tires in every station (Midgley, 2011).

Regarding the management of customers, a "**best practices**" list could improve bicycle durability through conscious use. Sometimes, users do things that hurt the physical integrity of the asset without knowing it. An example is ZYP that has a webpage dedicated to tips for a safe ride (Zyp, n.d. (a)). This list could also essential traffic rules and arm-signals for cyclists.

13. Conclusion: Synthesis of possible solutions

There are no perfect solutions and with new technologies and new generations bringing new ways of thinking, bike-sharing will go through many developments. Some companies have put in practice measures to tackle the numerous challenges, including: a simpler parallel payment system for one-time-users; offering classes to teach people how to ride a bicycle; incentives for customers to take bicycles from full to empty docks; providing customers with an easy platform to suggest new locations; building partnerships with companies to subsidize the membership of employees; investing in electric bicycles and solar chargers at the docks; assembling a system to share helmets; opting for bikes made of more durable materials; and creating a "best practices" list for a good use of the bicycles. While this paper presents a conceptual benchmarking of processes, future work must focus on financial analysis and market research to find the appropriate way to implement them.

List of references (for part B)

Bikeplus. 2016. "The Bikeplus Guide to Successful Bike Share Scheme Development." Accessed December 2. https://como.org.uk/wp-content/uploads/2018/06/Bike-Share-Procurement-Guidance-HI-RES.compressed.pdf.

CitiBike. N.d. "Bike Angels." Accessed December 2. https://www.citibikenyc.com/bikeangels.

Corrêa, Henrique. 2018. "Servitization meets sustainability." *Future Studies Research Journal: Trends & Strategies* 10 (2): 358-364.

Corwin, Scott; Dinamani, Anant; and Pankratz, Derek. 2019. "Toward a mobility operating system: Establishing a lingua franca for urban transportation." *Deloitte Insights*.

Divvy. N.d. "Divvy Suggestion Map." Accessed December 2. http://suggest.divvybikes.com/page/about.

Fishman, Elliot; Washington, Simon; and Haworth, Narelle. 2012. "Barriers and facilitators to public bicycle scheme use: A qualitative approach." *Transportation Research Part F: Traffic Psychology and Behaviour* 15 (6): 686–698.

Frei, Frances. 2008. "The Four Things a Service Business Must Get Right". *Harvard Business Review*.

Hernandez, Omar. N.d. "Brooklyn hospital uses bike share to promote employee and patient wellness." http://betterbikeshare.org/2017/06/21/brooklyn-hospital-uses-bike-share-promote-employee-patient-wellness/.

Indego. N.d. "Classes & Rides." Accessed December 2. https://www.rideindego.com/how-it-works/education-classes/.

Krug, Frances. N.d. "Electric Bikes vs. Regular Bikes: What's The Real Difference No One Talks About." Accessed December 2. https://www.evelo.com/blog/electric-bikes-vs-regular-bikes/.

Midgley, Peter. 2011. "Bicycle-sharing schemes: Enhancing sustainable mobility in urban areas." *United Nations, Department of Economic and Social Affairs*.

MobiCascais. N.d. (b). "Condições Gerais de Utilização dos serviços de Bike Sharing e de Bike Parking." Accessed December 2. https://www.mobicascais.pt/assets/cascais/docs/terms-conditions.pdf.

Mobibikes. N.d. “Frequently Asked Questions.” Accessed December 2. https://www.mobibikes.ca/en/faq.

Morpher. N.d. “The foldable helmet.” Accessed December 2. https://www.morpherhelmet.com/.

National Association of City Transportation Officials. N.d. “Strategies for Engaging Community.” Accessed December 2. https://nacto.org/wp-content/uploads/2018/09/NACTO_BBSP_2018_Strategies-for-Engaging-Community.pdf.

Nice Ride Minnesota. N.d. “Discover #NiceRideArt around Minneapolis.”. Accessed December 2. https://www.niceridemn.com/blog/niceridеart.

Noctula. N.d. “O guia essencial para perceber a energia solar.” Accessed December 2. https://noctula.pt/energia-solar/.

Shaheen, Susan; Guzman, Stacey, and Zhang, Hua. 2010. “Bikesharing in Europe, the Americas, and Asia: Past, Present, and Future.” *Washington D.C.: Transportation Research Board Annual Meeting*.

Sumner, Jason. 2018. “The Differences Between Bike Frame Materials—Explained.” Accessed December 2. https://www.bicycling.com/bikes-gear/a21784287/bike-frame-materials-explained/.

Toole Design Group and the Pedestrian and Bicycle Information Center.2012.“Bike Sharing in the United States: State of the Practice and Guide to Implementation.” Accessed December 2. https://www.bikesharing.ch/fileadmin/redaktion/bikesharing/Dokumente/Documents_et_autres/Bikesharing_in_the_United_States.pdf.

Velib’ Metropole. N.d. “The Vélib’ service.” Accessed December 2. https://www.velib-metropole.fr/en_GB/discover/service.

Yang, Miying, and Evans, Steve. 2019. “Product-service system business model archetypes and sustainability.” *Journal of Cleaner Production* 220: 1156–1166.

Zyp. N.d. (a). “Safety riding tips.” Accessed December 2. https://www.zypbikeshare.com/safety-riding-tips/.

Zyp. N.d. (b) “Stations.” Accessed December 2. https://www.zypbikeshare.com/about/stations/.

Exhibits (for part B)

Exhibit 5 – Blueprint of the process for clients.

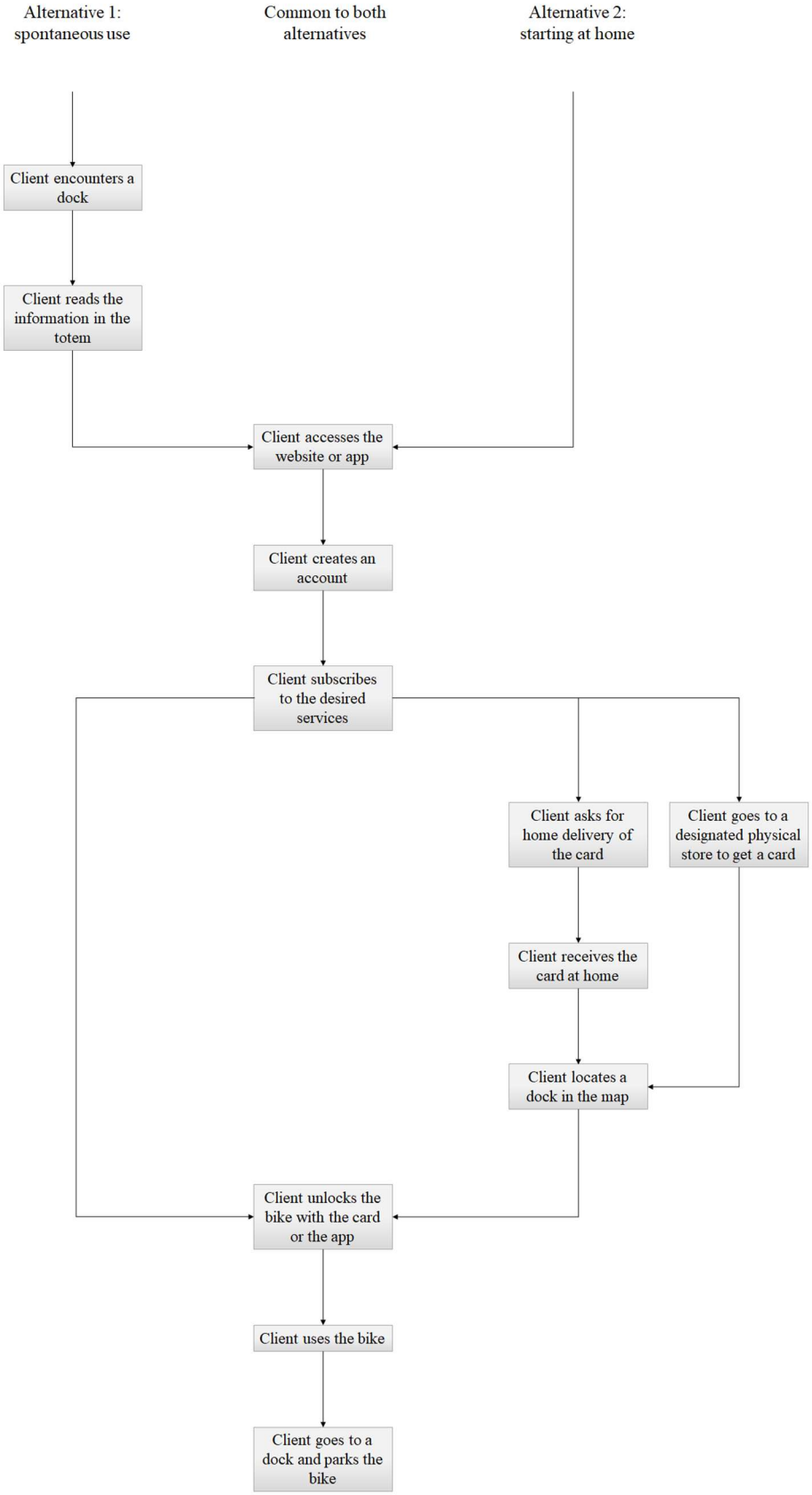


Exhibit 6 – Bike powered trailer for bicycle redistribution, by San Antonio B-cycle.

Exhibit 7 – Folding helmet by Morpher.